REMARKS/ARGUMENTS

Claims 75-83 and previously amended claims 39, 41-48, 50-56 and 74 are pending in this application. Applicants reserve the right to pursue the original claims and other claims in this application and in other applications.

Claims 39 and 41-47 stand rejected under 35 U.S.C. § 103 as being unpatentable over Laibowitz et al. (U.S. Patent No. 6,088,216)("Laibowitz") in view of Azuma et al. (U.S. Patent No. 5,516,363) ("Azuma"). In particular, the Office Action states that "Laibowitz discloses (see, for example, FIG. 7) a DRAM capacitor comprising a substrate (material layer) 12, whereupon a mesa (a first level and a second level, sidewall region) 51 and high dielectric film (high dielectric constant thin film material) 56 are formed. Laibowitz does not disclose doping of said BST high dielectric thin film material being such that the stoichiometry of said BST high dielectric thin film material is substantially uniform at least at said sidewall region. However, Azuma discloses (see, for example, column 6, lines 35-45) that doping with additional A or B site type element in an ABO_3 dielectric, such as BST, of a DRAM capacitor will keep uniform the overall stoichiometric ratio. Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention to dope A or B elements in the high dielectric film of Laibowitz so that a uniform stoichiometry is maintained. a. Regarding the limitation of "a BST film", see column 2, lines 55-* where Laibowitz discloses the use of barium titanate, strontium titanate and *its mixtures.* b. Regarding claim 44, Laibowitz in view of Azuma discloses the claimed invention except for a Ti percentage of about 50% to about 53.5% throughout said BST high dielectric film. However, it would have been obvious to one of ordinary skill in the art at the time of the invention was made to dope with Ti until this range is met, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or working ranges involves only routine skill in the art. *In Re Aller*, 105 USPQ 233." Reconsideration is respectfully requested.

Claim 39 recites, inter alia, a capacitor comprising "a material layer having a first level and a second level, said first and second levels being connected by a sidewall region between said first and second levels; and an ion implantation doped BST high dielectric constant thin film material formed at least on said sidewall region; the doping of said BST thin film material being such that the stoichiometry of said BST high dielectric thin film material is substantially uniform at least at said sidewall region."

The present invention is directed to ensuring a uniform stoichiometry in BST high dielectric thin film material when the material is applied to a sidewall, or to form a sidewall. The film structure's stoichiometry is critical to the electrical functionality of the film. Therefore, a uniform stoichiometry is necessary to ensure that this the film has good dielectric properties. Applying a thin film dielectric material to form a sidewall, or over a sidewall, formed by a mesa, step, cap, or another three dimensional structure, usually effects the stoichiometry of the thin film dielectric layer. The resulting thin film layer will have a inhomogeneous stoichiometry and a decreased percentage of Titanium. The present application addresses and solves this issue by ensuring that the BST thin film dielectric applied either over, or to form, a sidewall have a uniform stoichiometry to maintain the good dielectric properties. This is accomplished by the doping of the BST material to produce a substantially uniform stoichiometry at least at a sidewall region.

Laibowitz discloses a capacitor using a high dielectric constant material, and method of making it, which seeks to address the problem in which a bottom electrode and a dielectric layer chemically interact to form a silicon layer in series or below the desired dielectric layer. Although Laibowitz discloses sidewalls of a mesa or a stack, i.e., a capacitor, covered by a thin film dielectric material, Laibowitz does not disclose or suggest maintaining a uniform stoichiometry of thin film dielectric material on the sidewall. Laibowitz also fails to disclose the importance of a maintaining a uniform stoichiometry in the layer of thin film dielectric material on a sidewall. Furthermore, Laibowitz does not disclose or suggest that a sidewall, created by a mesa, stack, trench, or other three dimensional object, effects the stoichiometry of a layer of dielectric material applied over

the sidewall. As noted in the office action, "Laibowitz does not disclose doping of said BST high dielectric thin film material being such that the stoichiometry of said BST high dielectric film material is substantially uniform at least at said sidewall regions."

Azuma discloses a method for producing specially doped dielectric compositions having high dielectric constants and low conductive leakage currents. Azuma discloses a method to achieve a uniform stoichiometry in dielectric materials by adding doping, and possibly adding a dopant compensator, to the formulation of the precursor material. Although Azuma may suggest that additional doping or dopant compensator (B or A site material) may be required in the formulation of the precursor material to maintain a uniform stoichiometry in the precursor, Azuma does not disclose or suggest that the application of a thin film dielectric layer over a sidewall, or to form a sidewall, will effect the uniform stoichiometry of the resulting thin film dielectric material layer. According to Azuma, the precursor dielectric material is applied to the substrate after adding the additional doping. Therefore, the precursor material is applied after attempting to homogonize the material's stoichiometry and before the stoichiometry will be effected by applying the material over a sidewall or to form a sidewall.

Furthermore, Azuma's application method is directed toward two dimensional surfaces as the application discloses a "spin on" method to apply the precursor material to form a thin film dielectric layer. As seen in Azuma FIG. 3, Azuma suggests the application of dielectric materials to horizontal surfaces. Azuma does not suggest application of the precursor thin film dielectric material to sidewalls or to form sidewalls. Nor does Azuma suggest or disclose the problem of maintaining the stoichiometry of thin film dielectric material when applied to a sidewall formed from mesas, steps, trenches, or other three dimensional structures. Furthermore, Azuma does not suggest or disclose any particular techniques to apply the thin film dielectric material to a sidewall associated with a mesa, stack, trench or other three dimensional structure on the substrate that will maintain the uniform stoichiometry of the thin film dielectric material on the sidewall. Therefore, the precursor may have a uniform stoichiometry when formulated, but after applying the

precursor to sidewalls, the thin film dielectric layer may no longer have a uniform stoichiometry.

Only the present application identifies and addresses the problem of maintaining a substantially uniform stoichiometry of the thin film dielectric material layer film on a side wall formed by a mesa, stack, trench, or other three dimensional structure. Since neither of the references identify or recognize the problem, which is solved by the claimed invention, there is no motivation, teaching or suggestion in the references for the claimed invention. If the prior art does not even recognize the problem, the solution to the problem can not be deemed obvious. See, In re Sponnoble, 405 F.2d 578, 160 U.SP.Q. 237 (C.C.P.A. 1969); Ex parte Campbell, 211 U.S.P.Q. 575 (Bd. App. 1981). Neither Azuma nor Laibowitz identify or recognize the problem addressed by the invention, much less disclose or suggest its solution. Nor is there any motivation to combine Azuma with Laibowitz. Accordingly, the rejection of claim 39 should be withdrawn.

Claims 41-47 depend from claim 39 and likewise the requirement that the stoichiometry of the BST high dielectric film material is substantially uniform at least at the sidewall regions is not disclosed or suggested by Laibowitz in view of Azuma. Accordingly, the rejection of those claims should be withdrawn.

Claims 48 and 50-56 stand rejected under 35 U.S.C. § 103 as being unpatentable over Laibowitz in view of Azuma as applied to claims 39, and 41-47 above, and further in view of Leung et al. (U.S. Patent No. 5,563,762) ("Leung"). In particular, the Office Action states that "Laibowitz in view of Azuma does not have a capping layer. However, Leung discloses that a capping layer may be formed to encapsulate a capacitor structure. See, for example, column 2, lines, 27-56. Leung teaches that adding a capping layer protects the capacitor from diffusion and contamination. Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to include a capping layer in the capacitor structure of Laibowitz in view of Azuma so that the above

cited problems can be avoided." Reconsideration is respectfully requested.

Claim 48 recites, inter alia, a capacitor comprising "a material layer having a first level and a second level, said first and second levels being connected by a sidewall region between said first and second levels; an ion implantation doped BST high dielectric constant thin film material formed at least on said sidewall region; the doping of said BST thin film material being such that the stoichiometry of said BST high dielectric thin film material is substantially uniform at least at said sidewall region; and a capping layer provided over at least a portion of said BST thin film material."

Leung discloses a capacitor and method of forming an integrated circuit and a method of adding on-chip capacitors to an integrated circuit. As part of this disclosure, Leung discloses a that a capping layer may be formed to encapsulate a capacitor structure. Although Leung discloses dielectric layers covering a mesa, step, trench, or some other three dimensional structure that is on, or part of, the substrate, Leung fails to disclose or suggest that a side wall, formed by a mesa, step, trench, or some other three dimensional structure, effects the uniform stoichiometry of a thin film dielectric layer on a sidewall. Therefore, Leung does not disclose or suggest a solution to overcome the lack of uniform stoichiometry of a thin film dielectric layer of material applied on a side wall of a three dimensional structure. Since Leung nor Azuma nor Laibowitz do not identify or solve the problem addressed by the present invention, they fail to disclose the present invention. Nor is there any motivation to combine Leung with Azuma and Laibowitz. Accordingly, the rejection of claim 48 should be withdrawn.

Claims 50-56 depend from claim 48 and likewise the requirement that the stoichiometry of the BST high dielectric film material is substantially uniform at least at the sidewall regions is not disclosed or suggested by Laibowitz in view of Azuma and Leung. Accordingly, the rejection of those claims should be withdrawn.

Claims 74-83 stand rejected under 35 U.S.C. § 103 as being unpatentable over

Hosotani et al. (U.S. PTO No. 6,051,859) ("Hosotani") in view of Azuma. In particular, the Office Action states that "Hosotani discloses (see, for example FIG. 7B and column 12, lines 31-44) a capacitor comprising a substrate 31, first electrode 32, dielectric film 34 and second electrode 35. Hosotani does not disclose doping said dielectric film such that the stoichiometry of said film is substantially uniform at least at said sidewall region. However, Azuma discloses (for example, column 6, lines 35-45) that doping with additional A or B site type element in a ABO_3 dielectric of a DRAM capacitor will keep uniform the overall stoichiometric ratio. Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to dope A or B elements in the high dielectric film of Hosotani so that a uniform stoichiometry is maintained." Reconsideration is respectfully requested.

Claim 74 recites, inter alia, an integrated circuit capacitor device comprising: "a material layer having a first level and a second level, wherein said first and second levels are connected by a sidewall region between said first and second levels; a first electrode provided at least on said sidewall region; a doped BST high dielectric constant thin film material provided on said first electrode, the doping of said BST high dielectric thin film material being such that the stoichiometry of said BST high dielectric thin film material is substantially uniform at least at said sidewall region; and a second electrode provided on said BST high dielectric thin film layer."

Hosotani discloses a stacked type capacitor semiconductor device formed on the contact hole of the underlying insulating film, and method for manufacturing the device. Hosotani does disclose or suggest maintaining uniform stoichiometry of thin film dielectric material on a sidewall structure. As the Office Action points out, "Hosotani does not disclose doping said dielectric film such that the stoichiometry of said film is substantially uniform at least at said sidewall region." Nor does Azuma address maintaining the stoichiometry of a BST high dielectric film material being substantially uniform at the sidewall regions. Since Hosotani nor Azuma do not solve the problem addressed by the present invention, they fail to disclose the present invention. Accordingly, the rejection of

claim 74 should be withdrawn.

Claims 75-83 depend from claim 74 and likewise the requirement that the stoichiometry of the BST high dielectric film material is substantially uniform at least at the sidewall regions isnot disclosed or suggested by Hosotani in view of Azuma. Accordingly, the rejection of those claims should be withdrawn.

In view of the above, each of the presently pending claims in this application is believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to withdraw the outstanding rejection of the claims and to pass this application to issue.

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Respectfully submitted,

By_____

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